# STATUS OF MINERAL RESOURCE INFORMATION FOR THE SANDIA PUEBLO INDIAN RESERVATION NEW MEXICO

Administrative Report BIA-55
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By

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## SUMMARY AND CONCLUSIONS

Production of mineral commodities on the Sandia Pueblo Indian Reservation has been limited to sand and gravel and quartz. All indications are that sand and gravel will continue to be produced.

The reservation may have promise for discovery of uranium and oil and gas. Little possibility exists for the discovery of metallic minerals.

## INTRODUCTION

This report was prepared for the Bureau of Indian Affairs by the U.S. Geological Survey and the Bureau of Mines under an agreement to compile and summarize available information on the geology, mineral resources, and potential for economic development of certain Indian lands. Source material included published and unpublished reports, as well as personal communications. There was no field work.

The Sandia Pueblo Indian Reservation is an irregularly shaped area at the northern end of the Sandia Mountains in central New Mexico about 13 miles north-northeast of the city of Albuquerque (Figure 1). The reservation comprises an area of approximately 22,900 acres in Sandoval and Bernalillo Counties. All land is tribally owned. The population of the reservation is about 200 (U.S. Department of Commerce, 1974).

The Rio Grande forms the western boundary of the Sandia Reservation. From west to east elevations increase from about 5,000 feet at the Rio Grande to about 7,400 feet near the eastern boundary in the Sandia Mountains. Interstate Highway 25 passes through the western edge of the reservation, and both improved and unimproved Bureau of Indian Affairs roads afford access to the remainder of the area (Figure 1). According to the U.S. Department of Commerce (1970, p. 33-11), principal cities and towns of the area include Albuquerque (population 243,751), Santa Fe (population 40,167), and Bernalillo (population 2,016).

### Previous Work

Kelley and Northrop (1975) studied this area and summarized previous work. Jules Marcou studied fossils and prepared a reconnaissance geologic map of this area in the 1850's; his field notes were translated into English by W. P. Blake (1856). W. G. Tight prepared a map of the Sandia Mountains in 1907 (Kelley and Northrop, 1975). Ellis (1922) published "Geology of the Sandia Mountains" and portions of these mountains were included in University of New Mexico Master's theses by Hayes (1951), Shomaker (1965), Feinberg (1969) and Enz (1974). The Sandia Granite has been studied widely; age determinations of the granite were made by Aldrich and others (1957, 1958), Brookins (1973, 1974), Poupeau (1969), and many others. Lambert (1968) studied the Quaternary stratigraphy of the Albuquerque area. The Sandia Reservation is also included in recent reports by Kelley (1977, 1978).

### Physiography

Approximately 3,000 feet of relief occur in the Sandia Reservation. The steep western face of the Sandia Mountains is in the eastern portion of the reservation; it is bordered on the west by alluvial

fan deposits. A broad pediment surface dips toward the Rio Grande. The western portion of the reservation is covered with Rio Grande alluvium and is nearly level; remnants of older terraces occur on either side of the alluvium.

## GENERAL GEOLOGY

### Stratigraphy

Precambrian crystalline rocks and Pennsylvanian, Triassic, Jurassic, Tertiary, and Quaternary sediments underlie the Sandia Pueblo Reservation (Figure 2).

#### Precambrian Rocks

Metamorphic Rocks.--Hayes (1951) estimated that the metamorphic rocks at Rincon Ridge, which he called the Juan Tabo sequence, are more than 7,000 feet thick. The most abundant rock types are micaceous quartzite and micaceous quartz schist. Feldspar and sillimanite schists occur near the Sandia Granite; patches of greenstone and chlorite schist occur along the northwest portion of Rincon Ridge in secs. 14 and 22, T. 12 N., R. 4 E. (Kelley and Northrop, 1975).

Sandia Granite.--The Sandia Granite, 1,500+100 million years old, is a porphyritic granite which is homogeneous throughout its exposures, but varies from light- to medium-gray to pinkish and light-reddish brown. Pink microcline phenocrysts, believed colored by hematite or iron in solid solution (Shomaker, 1965), give the granite its pinkish color.

Shomaker (1965) noted that epidote, chlorite, and hematite alteration of hydrothermal origin is common along fractures in the Sandia Granite and younger aplitic dikes. Faulting occurred along these alteration zones and extended into overlying Pennsylvanian strata, even though the alteration zones do not extend into the Pennsylvanian rocks. Shomaker (1965) also observed that highly altered Sandia Granite is more resistant to weathering than the unaltered granite and forms low ridges and knobs.

The Sandia Granite crops out for 20 miles along the Sandia Mountains, from Four Hills in T. 9 N. to near Placitas, due east of Bernalillo (Kelley and Northrop, 1975).

Dikes and Sills.--Hayes (1951), Shomaker (1965), and Feinberg (1969) mapped numerous dikes and sills in the Sandia Granite and the metamorphic rocks at Rincon Ridge. The dikes range from an inch to 50 feet thick and may be up to one mile long; they are not associated with well-defined faults. Kelley and Northrop (1975) divided these intrusions into four categories: 1. pegmatite, 2. aplite, 3. composite aplite-pegmatite, and 4. silexite (quartz).

Pegmatites, up to 10 feet wide and 3,000 feet long, are the dominant type in the metamorphic rocks (Hayes, 1951) and may contain accessory garnet, mica, or black tourmaline (Kelley and Northrop, 1975). Thin, small aplite dikes contain quartz, orthoclase, accessory muscovite, and up to 10 percent garnet (Kelley and Northrop, 1975). Aplite-pegmatite dikes are composed of microcline-microperthite, quartz, and oligoclase

with minor biotite and muscovite and very minor apatite, pyrite, tourmaline, beryl, magnetite, and ilmenite; they are the dominant type of dike in the granite (Kelley and Northrop, 1975). Silexite (quartz) dikes may contain black tourmaline (Kelley and Northrop, 1975).

### Pennsylvanian Rocks

Pennsylvanian rocks (Figure 2) crop out on the eastern slope of the Sandia Mountains, and may underlie the Sandia Pueblo Reservation at depth.

### Triassic and Jurassic Rocks

A small patch of Triassic and Jurassic rocks crops out in Jaral Canyon at the eastern boundary of the reservation; these rocks probably underlie the reservation at depth.

### Tertiary Rocks

Santa Fe Formation.--Most of the sedimentary deposits which fill the Albuquerque basin in this area are in the Santa Fe Formation (Kelley, 1977). However, some deposits which retain their original geomorphology, such as terrace and pediment gravels, and recent alluvium, are excluded from this formation.

The lithology of the Santa Fe Formation varies greatly. Much of the formation is composed of buff, tan, and red-brown sandstone and mudstone. Fanglomerate units are up to 10 feet thick in the lower part of the formation and up to 200 feet thick in the upper part. The fanglomerates are interbedded with the thin- to thick-bedded sandstones and mudstones (Kelley, 1977). Kelley and Northrop (1975) distinguish two main sources for the Santa Fe sediments uplifts along the east and west boundaries of the Rio Grande trough and an upstream source along the trough. Both of these sources are evident from the various rock types included in the formation (Kelley, 1977).

### Quaternary Sediments

Pediment Gravel.--Pediments are erosional surfaces at the bases of mountains; gravel may be deposited on these surfaces. The pediment in the Sandia Reservation is more dissected, at a lower elevation, and apparently younger than the Ortiz pediment to the south (Kelley and Northrop, 1975). The pediment gravels were derived largely from dissection of the Santa Fe Formation.

Terrace Gravel.--Terrace gravels parallel stream valleys and are composed of subrounded to rounded gravel, generally derived from the subjacent Santa Fe Formation.

Windblown Sand.--Windblown sand deposits are located near Arroyo de la Barranca and Arroyo de los Montoyas, west of Sandia Reservation.

Alluvial Fan Deposits.--Sand and gravel deposits, most of them derived from Precambrian rocks, form an apron along the western slope of the Sandia Mountains.

Alluvium.--Clay, silt, sand, and gravel deposited by streams compose this unit.

## Structure

The Sandia Reservation is on the boundary between the Sandia Mountains to the east and the Albuquerque basin of the Rio Grande trough to the west. The fault which separates these two areas is visible along parts of the base of Rincon Ridge in the reservation (Figure 2).

The Sandia Mountains are an eastward dipping uplift bounded by faults. Pennsylvanian rocks form its crest and eastern flank. Kelley and Northrop (1975) delineated an anticline in the Precambrian rocks which dips to the northeast and is dissected by many faults.

The Rio Grande trough is the series of downfaulted intermontane basins through which the Rio Grande flows; it is believed to have started forming in Miocene time (Kelley, 1977). Kelley (1977, fig. 20) estimated that as much as 7,500 feet of sediments fill the Albuquerque basin in the Sandia Reservation. The structure of prebasin sediments in the Albuquerque basin is obscured by the Santa Fe Formation and younger sediments.

# MINERAL RESOURCES

## General

Mineral resources of the Sandia Reservation include sand and gravel and quartz. The area may have potential for uranium, and some possibility exists for discovery of petroleum and natural gas. Little possibility exists for the discovery of metallic minerals.

Current mineral production from the reservation is limited to sand and gravel, but quartz has been produced from a deposit in the Sandia Mountains.

## Energy Resources

Energy resources have not been discovered on the Sandia Reservation, but a possibility exists for the occurrence of oil and gas and uranium. There is little likelihood of coal at minable depths.

### Petroleum and Natural Gas

Petroleum and natural gas have not been discovered on the reservation. Shell Oil Corp., however, leased most of the reservation in 1970. Although Shell had received a prospecting permit, it expired in 1973 without drilling. According to Kelley and Northrop (1975, p. 118), the Pennsylvanian Sandia Formation is the most likely target for oil and gas exploration.

### Uranium

Uranium has not been discovered within the Sandia Reservation. Union Carbide Corp., however, is currently (1979) exploring a large block of private and State land not far from the northeastern boundary of the reservation. Although representatives of the company would not reveal the results of their exploration, they did indicate that their findings were sufficiently encouraging to warrant continued work in the area. A representative of Union Carbide indicated that the Galisteo Formation was the target for exploration efforts. Union Carbide sank an inclined shaft into a mineralized zone in sec. 16, T. 13 N., R. 6 E., to investigate the

feasibility of mining what a Department of Energy (DOE) representative described as a large, low--grade deposit with "hot spots" grading up to 0.1 percent $U_30_8$. Results of the feasibility study have not been released nor have plans for commercial production been announced. The Union Carbide representative further indicated that company personnel had examined available oil well logs and cuttings from the vicinity and that neither the Cretaceous Dakota Formation nor the Jurassic Morrison Formation in the region gave any indication of uranium mineralization. Hilpert (1969, p. 48) describes a uranium occurrence in the Galisteo Formation in T. 13 N., R. 6 E., about 10 miles east of the reservation, and the U.S. Atomic Energy Commission (1966, p. 45) shows a radioactive anomaly in the same area. It was in this general area that the Union Carbide shaft was sunk. Based on the information given by Union Carbide and DOE representatives, the Galisteo Formation underlying the reservation may have some potential for uranium discovery.

The Santa Fe Formation, which is thought by some investigators to hold considerable promise for uranium in other areas, is not considered to have great potential in or near the Sandia Reservation. (U.S. Geological Survey (USGS) and DOE personnel, personal communications.)

## Metallic Mineral Resources

Metallic mineral resources have not been discovered on the reservation. A small prospect, however, is about 125 yards from the northeastern corner. According to personnel of the USGS, it was a silver prospect carrying minor gold values. Kelley and Northrop (1975) show the prospect on maps and indicate that silver was the metal involved, but they do not describe the occurrence. They do, however, show mines that yielded copper, lead, and silver about 1.5 miles northeast of the prospect. According to personnel of the USGS (oral communication, 1979), mineralization at the prospect occurred in a series of small shears in a zone only a few inches wide. Unconfirmed reports indicate that the shear zone contained about 5 or 6 ounces of silver per ton and traces of gold. The prospect is small; only a few tons of material was mined, and it is unknown whether any ore was shipped. Although metallic mineral occurrences exist near the reservation, the probability of mineralized showings within reservation boundaries is remote.

## Nonmetallic Mineral Resources

Nonmetallic mineral resources that occur within the Sandia Reservation are quartz and sand and gravel. Currently, only sand and gravel is being mined, but a small amount of quartz has been produced.

### Quartz

An attempt was made to mine white barren quartz (bull quartz, or silexite) from a large vein in sec. 3, T. 11 N., R. 4 E., near Juan Tabo Canyon, about half a mile inside the reservation boundary (Figure 1). Elston (1967, p. 59) mentions the occurrence but neither describes the deposit nor gives production figures. The pit is small and could not have yielded more than a few hundreds

of tons of rock; the quartz probably was used in garden landscaping. Little information is available concerning the deposit, and reserves are unknown. The deposit is in a rather inaccessible location, and any future attempt to produce the material would require costly access roads and loading facilities.

## Sand and Gravel

Sand and gravel is the only mineral commodity that is being produced on the Sandia Reservation. According to Elston (1963, p. 54), nearly all material mined thus far has come from Quaternary terrace deposits of the Rio Grande. As is the case in most sand and gravel operations in the region, production from the reservation is from the lower terraces on the east side of-the Rio Grande. A representative of one of the companies producing sand and gravel on the reservation indicated that the material meets specifications for most common uses for aggregates. The material is not well sorted and requires some crushing and classification.

Currently, three companies produce sand and gravel from three deposits owned by the Sandia Indians; one other deposit is inactive at this time. The three private concerns produced a total of 150,315 tons of sand and gravel during 1978. Other companies and the State of New Mexico have produced sand and gravel in the past, but all leases except those held by current producers have expired. The three companies have leases that vary both in size and in royalty rates (Table 1).

TABLE 1

Summary of 1978 Sand and Gravel Operations on the Sandia Pueblo Indian Reservation *

| Company | Location | Lease size (acres) | 1978 production (short ton) | Royalty Rate (per short ton) or rental |
|---|---|---|---|---|
| Robert Johnson Sand and Gravel | Sec. 2 T. 11 N., R. 3 E. | 92.3 | 72,400 | $0.35 |
| Robert Johnson Sand and Gravel | Sec. 25, 26 T. 12 N., R. 3 E. | 43.0 | 0 | $1100.00 annual rental paid |
| Montoya Sand and Gravel | Sec. 7, 8, 18 T. 12 N., R. 3 E. | 31.6 | 40,000 | $0.21 |
| S&S Aggregates | Sec. 2 T. 11 N., R. 3 E. | | 38,000 | $0.30** |

* Source: BIA records.

** Royalty figure good through 1979 but increases to $0.35 through 1981 and to $0.40 in 1982.

Sand and gravel has been produced in the past by the New Mexico State Highway Department from pits in sec. 36, R. 12 N., R. 3 E., and secs. 11 and 12, T. 11 N., R. 3 E. Brown Construction Co. of Albuquerque produced sand and gravel from a 5-acre lease that BIA records indicate is in sec. 36, T. 13 N., R. 3 E. Although this location is not on reservation land, the tribe received a $300.00 advance and a royalty of $0.10 per short ton of production from the company. The Brown Construction lease expired in 1963. Two other construction companies produced sand and gravel from deposits on the reservation prior to 1965. The Mulvaney Construction Co. produced from a pit in sec. 3, T. 11 N., R. 4 E., and S. D. Cowart Contracting Co. produced from a pit in secs. 5, 7, 8, and 18, T. 12 N., R. 4 E. Production figures for these two producers were unavailable, although a royalty of $0.15 per short ton was paid to the tribe.

Sand and gravel resources on the reservation outside the Rio Grande river bed are probably sufficient to last for many years at the present rate of production. Sand and gravel resources within the river bed appear to have no potential now or in the foreseeable future.

## MAP COVERAGE

The reservation is covered by the following USGS 7.5-minute topographic quadrangle maps: Alameda, Placitas, Bernalillo, and Sandia Crest.

The USGS has also published an Albuquerque, N.M., map at a scale of 1:100,000, that includes the reservation and surrounding area, as well as base and geologic maps of the State of New Mexico. All listed maps may be ordered from:

U.S. Geological Survey
Branch of Distribution
Central Region
Box 25286
Denver, Colo. 80225

Another source of map coverage of the reservation is the U.S. Bureau of Land Management, which has published Master Title Plats and surface management maps. Both the maps and the plats may be ordered from:

Bureau of Land Management
Records Section
P.O. Box 1449
Santa Fe, N. Mex. 87501

An historical index may be obtained to accompany the Master Title Plats. The quadrangles, master title plats, and historical indexes should be ordered by township and range.

County road maps are available from:

New Mexico State Highway Department
Duplicating Services
P.O. Box 1149
Santa Fe, N. Mex. 87503

The New Mexico State Bureau of Mines in Socorro also is a good source of map information.

Aerial photographs of the reservation may be purchased from both the USGS and the U.S. Department of Agriculture (USDA). Agencies within the USDA from which photos may be obtained are the U.S. Forest Service and the U.S. Soil Conservation Service. Satellite imagery is available from the U.S. Geological Survey.

## RECOMMENDATIONS FOR FURTHER WORK

Actions that the Sandia Indian Pueblo tribe might consider to promote the development of mineral resources within reservation boundaries are:

1. Make efforts to interest private industry in uranium exploration.
2. Make efforts to encourage an investigation on the potential of the quartz vein in the Sandia Mountains.

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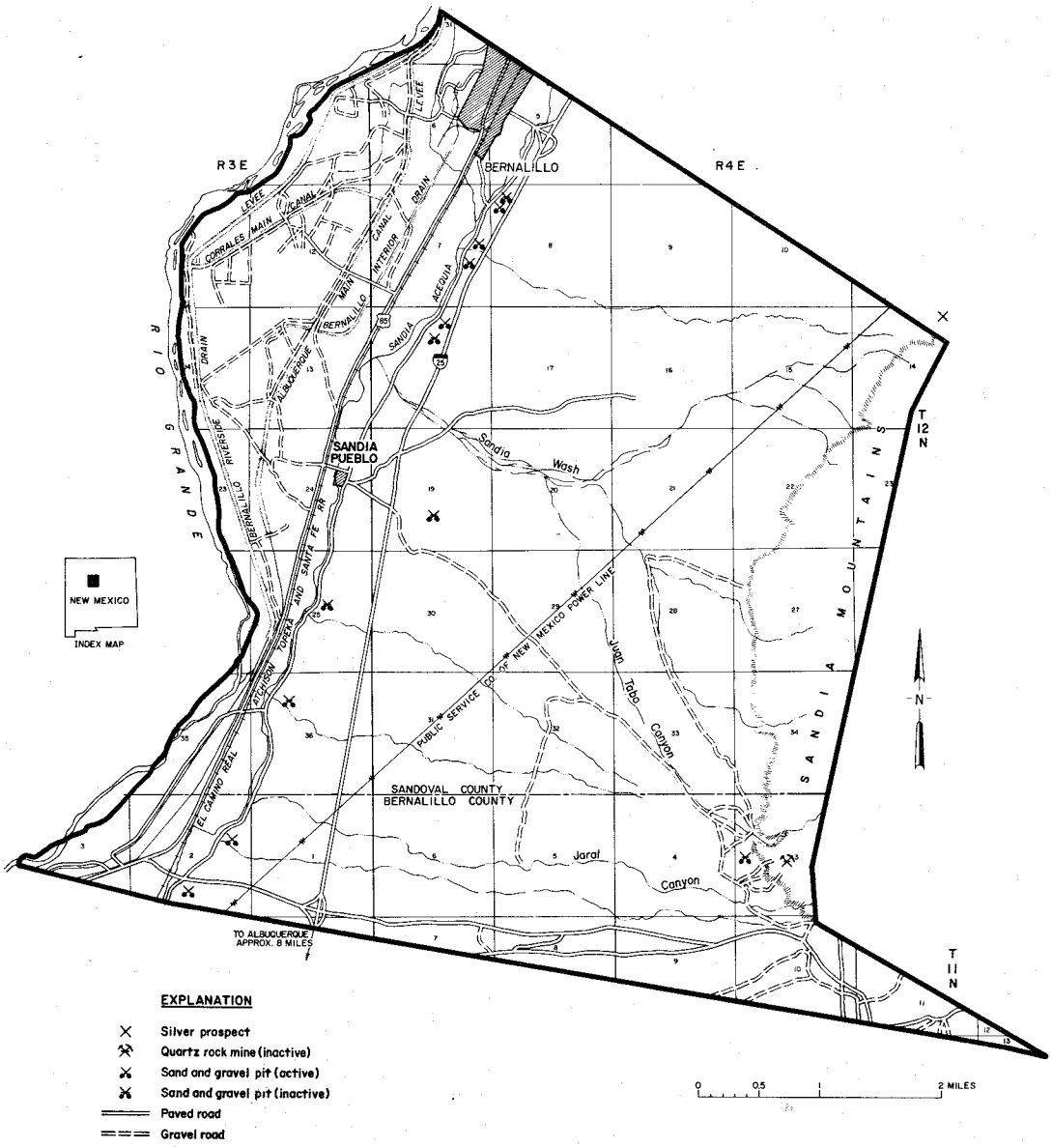


**Figure 1.** Index map and mineral occurrences on Sandia Pueblo Indian Reservation, New Mexico.

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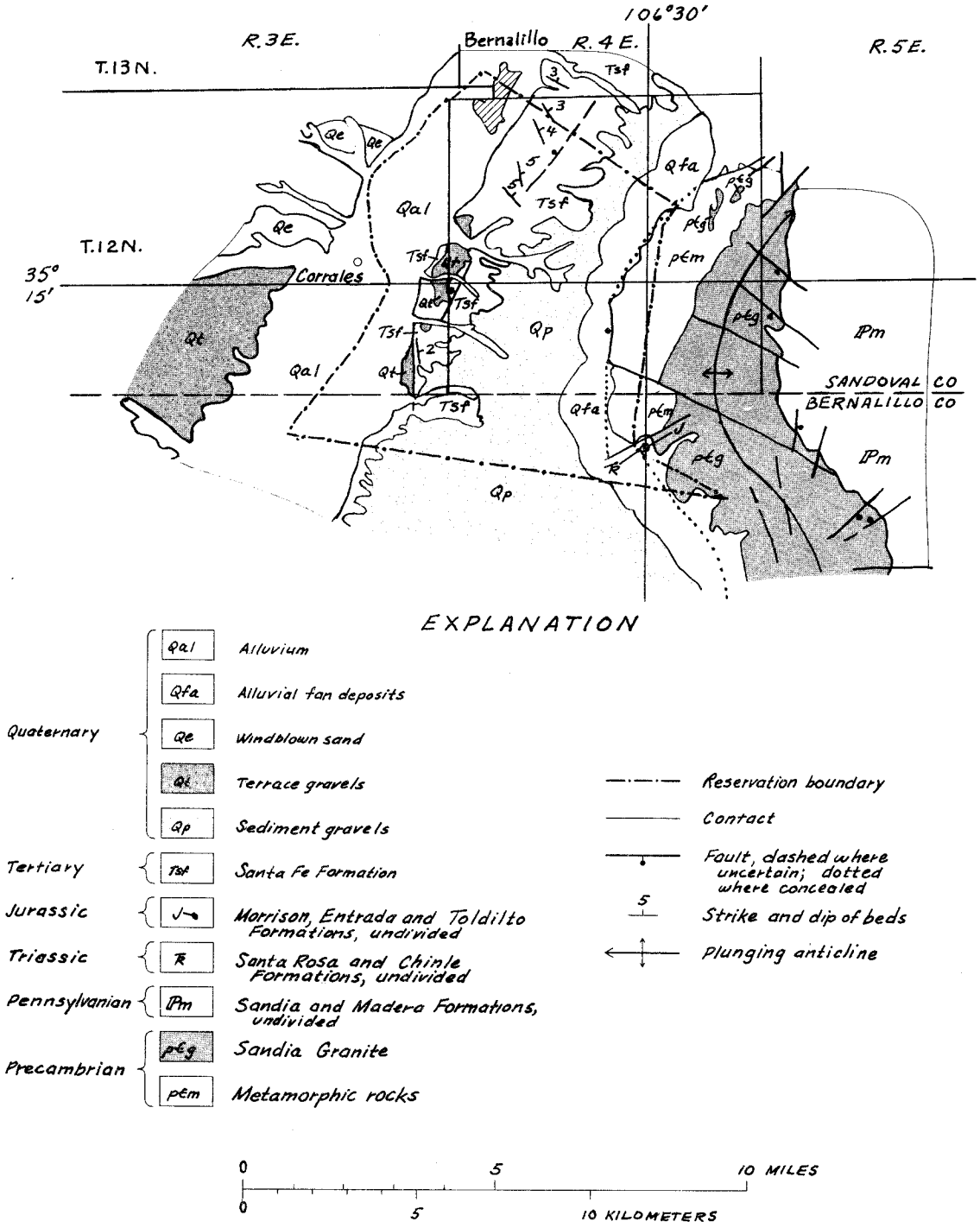


**Figure 2.** Geologic map of Sandia Pueblo Indian Reservation, New Mexico (modified from Kelley, 1977).